3-1-1990

Seagrass and Caulerpa Monitoring in Hillsborough Bay Initial Report

City of Tampa Department of Sanitary Sewers

SEAGRASS AND *CAULERPA* MONITORING IN HILLSBOROUGH BAY
INITIAL REPORT

submitted to

the Florida Department of Environmental Regulation
Tampa Office

March 1, 1990

by

City of Tampa
Department of Sanitary Sewers
Bay Study Group

INTRODUCTION

The City of Tampa, Bay Study Group (BSG), has monitored the effects of sewage pollution abatement in Hillsborough Bay since 1976. Within the last decade, water quality improvements and evidence of minor seagrass revegetation in Hillsborough Bay prompted the BSG to initiate a seagrass study to compliment other programs assessing the environmental status of Hillsborough Bay.

Documentation of natural seagrass coverage began in April 1986 with a thorough groundtruthing effort which located and described Halodule wrightii, Ruppia maritima and the attached benthic alga, Caulerpa prolifera. A second intensive groundtruthing effort to document H. wrightii was completed in October 1989. In addition, study sites have been established for each species which are periodically monitored.

The BSG, in cooperation with the FDNR and the NMFS Tampa Bay Experimental Seagrass Planting Effort, has also been involved in two transplantings of seagrass into Hillsborough Bay. The first transplanting effort occurred during June and July of 1987 utilizing H. wrightii source material from the Courtney Campbell road widening project. About 900 H. wrightii "bare root" units were planted in an intertidal area adjacent to western Interbay Peninsula. In addition, nearly 350 H. wrightii "sod blocks" were planted in seven areas of Hillsborough Bay using the Courtney Campbell source material. The second transplanting effort occurred in May 1989 and utilized source material from Port Manatee. Two 10x20m subtidal plots were planted in Hillsborough Bay with H. wrightii and Syringodium filiforme "sod blocks." Both efforts were designed to locate areas of Hillsborough Bay suitable for seagrass transplanting, to establish a source of vegetative material, and to determine if artificially introduced seagrass could generate functional seagrass communities.

This is first annual report to FDER to satisfy the requirements set forth in specific condition #6 of FDER construction permit DC29-152790. The areal coverage and growth trends for natural and introduced H. wrightii and natural C. prolifera will be discussed.

METHODS

The report by the BSG, "An Ongoing Survey of Halodule wrightii, Ruppia maritima, and the Alga, Caulerpa prolifera in Hillsborough Bay, Florida: Initial Assessment and Design" describes study site locations and experimental design for the naturally occurring seagrass and C. prolifera projects. A copy of the report is enclosed. It does not, however, contain seagrass transplanting information. Therefore, a description of the transplanting methods is included below.

STUDY SITE LOCATIONS AND SURVEY TIMES:

Study site locations for natural H. wrightii, transplanted seagrass and C. prolifera are shown in Figures 1, 2 and 3 respectively. Surveys occurred during the spring, summer and fall for the respective years shown in Table 1.

Table 1. Surveys by season are listed. Sp, Su and F represent spring, summer and fall respectively.

Survey	1	2	3	4	5	6	7	8	9	10
Season	F86	Sp87	Su87	F87	Sp88	Su88	F88	Sp89	Su89	F89

Only the eight natural H. wrightii study sites were assessed in Surveys 1 and 2. All subsequent surveys involved the assessment of both natural and transplanted seagrasses.

TRANSPLANT METHODS:

H. wrightii "sod block" and "bare root" units were used in the initial transplanting effort during June and July of 1987. Approximately 350 pieces of sod removed from the Courtney Campbell area, were planted at seven areas around Hillsborough Bay.

Areas 2 through 7 (Figure 2) were planted at predetermined elevations at various locations in Hillsborough Bay. Each area contained sod planting sites spaced 50m apart in transects following the shoreline. Transect lengths ranged from 100 to 1675m. Each sod planting site consisted of two "sod blocks" planted 1m from one PVC pole. At each site, "sod blocks" were placed on opposite sides of the pole. The average sod measured 14x23x15cm and contained 170 short shoots and 23 apical meristems.

Four parallel 1000m transects were planted in Area 1 (Figures 2 and 4) using the same method described for Areas 2 through 7. Area 1 transects, however, were not planted at predetermined elevations and were oriented in a north to south direction. Area 1 is located in the region of southeastern Hillsborough Bay known as the Kitchen.

A 10x20m plot was planted at a predetermined elevation in Area 8 with 861 "bare root" units. An average unit contained 15 short shoots and 3 apical meristems and was planted on 0.5m centers using a 15cm steel staple as an anchor.

Two additional 10x20m plots were planted in the Kitchen area (Figure 4), in May 1989, using source material from Port Manatee. One plot was planted with H. wrightii and the other plot was planted with S. filiforme. The location for these plots appeared suitable for transplants based on the results from the 1987 plantings. Each

monospecific plot contained 66 "sod blocks" planted on 2m centers. The average H. wrightii sod measured 15x24x15cm and contained 129 short shoots and 21 apical meristems. The average S. filiforme sod measured 18x25X15cm and contained 110 short shoots and 10 apical meristems. A fall 1989 assessment was made for these plantings and the assessment along with the 1990 data will be discussed in the next annual report.

RESULTS AND DISCUSSION

Halodule wrightii (Natural):

During the initial seagrass survey of Hillsborough Bay in April 1986, the BSG located and described 137 discrete patches of H. wrightii with a baywide coverage totaling about 1960m^2. About 61 percent of the total number of patches, representing 57 percent of H. wrightii areal coverage in Hillsborough Bay, were located in the Kitchen (Figure 4).

In the most recent survey, conducted in October 1989, the BSG located and described 394 discrete patches of H. wrightii, which is an increase of 190 percent in three years. Further, total H. wrightii areal coverage had increased 140 percent since the initial survey to the present cover of about 4700m^2. During the recent survey, the Kitchen had 69 percent of the total number of H. wrightii patches and 67 percent of the areal coverage in Hillsborough Bay.

Total areal coverage for the eight selected study sites increased from 147m^2 in 1986 to 522m^2 in 1989. Table 2 shows the areal coverage by survey for each study site.

Table 2. Areal coverage (m^2) by survey for Halodule wrightii study sites.

	SURVEY									
SITE	1	2	3	4	5	6	7	8	9	10
K-1	17	8	18	26	12	17	20	11	8	22
K-2	8	6	13	8	3	5	6	4	6	10
K-3	19	21	26	34	39	48	56	67	75	67
K-4	12	15	20	0	0	0	0	0	0	0
K-5	47	50	61	67	80	107	114	198	240	275
T-1	16	19	23	22	22	18	49	30	22	46
B-1	12	12	18	21	23	23	35	40	49	66
M-1	16	14	20	25	15	15	18	17	24	36
TOTAL	147	145	199	203	194	233	298	367	424	522

Changes in areal coverage over the ten surveys varied at the study sites. Study sites K-3 (Figure 5) , K-5 (Figure 6) and B-1 (Figure 7) had relatively steady increases in areal coverage over the study period. Study sites M-1 (Figure 8) and T-1 (Figure 9) were sporadic in seasonal growth but both sites have more than doubled areal coverage since the initial assessment. Study sites K-1 (Figure 10) and K-2 (Figure 11) also exhibited sporadic seasonal fluctuations in growth, and areal coverage for these sites has remained fairly constant. Study site K-4 (Figure 12) lost all H. wrightii in late 1987. A thick macroalgae mat, mostly Ulva lactuca, covered the site for nearly three months and apparently caused the seagrass loss at K-4.

Study sites were selected to follow the progress of seagrass growth in Hillsborough Bay. Using the study site information to extrapolate H. wrightii areal coverage in Hillsborough Bay overestimated actual 1989 coverage by about 40 percent. Therefore, frequent and large scale surveys using aerial photography and on-site groundtruthing, are imperative for accurate determinations of seagrass coverage.

Halodule wrightii (Transplants):

In October 1989, two years after the initial planting of H. wrightii "sod block" and "bare root" units, transplants persisted in five of eight test areas. H. wrightii "sod blocks" have expanded from an initial coverage of 10.7m^2 in 1987 to the present coverage of about 190m^2. "Bare root" units, planted in Area 8 (Figure 2) in a 10x20m plot have increased in areal coverage by two orders of magnitude from 2.3m^2 to 220m^2. Table 3 shows coverage at the transplant areas by survey.

Transplants did not survive in Area 3 (Figure 2), Area 4 (Figure 2), and Area 6 (Figure 2). Area 3 is subject to wakes from frequent ship traffic and this high energy zone may not be conducive to successful transplant attempts. Area 4 is adjacent to a large stormwater culvert and cover by debris discharged from this culvert probably caused the loss of transplants at this site. Area 6 had small areas of natural H. wrightii at the time of the transplanting effort. However, dense mats of macroalgae covered the area for several months in early 1988 and apparently killed both the natural and the transplanted H. wrightii.

Areas of persisting transplants (Areas 1,2,5,7,and 8; Figures 13-17) have shown very similar patterns of growth since initially planted in 1987. In general, little change occurred in the first year (Surveys 3-5 or 6). All areas, however, exhibited substantial growth between the summer of 1988 (Survey 6) through the fall of 1989 (Survey 10). Only Area 1, in the Kitchen, showed sporadic changes in growth during 1989 (Surveys 8-10).

Table 3. Areal coverage (m^2) by survey of H. wrightii "sod block" plantings in Areas 1-7 and H. wrightii "bare root" units in Area 8. (INIT = Initial)

	SURVEY								
AREA	INIT	3	4	5	6	7	8	9	10
1	5.3	2.2	4.4	1.4	21.9	57.6	59.7	13.9	59.2
2	2.1	0.4	0.5	0.2	9.1	13.3	26.7	58.4	61.5
3	0.4	0.7	0.9	0.0	0.0	0.0	0.0	0.0	0.0
4	0.2	0.2	0.5	0.1	0.0	0.0	0.0	0.0	0.0
5	0.6	0.5	0.3	0.4	0.4	1.7	4.8	5.5	15.5
6	0.4	0.6	0.8	TRACE	0.0	0.0	0.0	0.0	0.0
7	1.7	0.6	0.5	0.6	5.4	8.5	16.6	42.7	64.7
8	2.3	1.8	6.7	1.8	45.8	70.6	78.8	176.4	223.3
TOTAL	13.0	7.0	14.6	4.5	82.6	151.7	186.6	296.9	424.2

Caulerpa prolifera

Since 1986, when coverage was first documented in Hillsborough Bay, C. prolifera has been characterized by its ability to rapidly grow and vegetate large areas of subtidal flats in a short time period. Although true, C. prolifera coverage has also been observed to quickly diminish from vast areas due to sudden die-offs caused by apparent environmental stress. Growth has been observed in four general areas of Hillsborough Bay: 1) along the southeastern Interbay Peninsula; 2) near Ballast Point; 3) along Davis Island; and 4) between Pendola Point and Archie Creek. Documentation of coverage in these areas has been assessed by aerial photography from helicopter overflights and by measuring the percent cover in marked-off transects.

The subtidal flats (<3m in depth) along the southeastern Interbay Peninsula represents a region where C. prolifera has exhibited both rapid vegetation and rapid loss in coverage. Estimates from aerial photography documented a 40 fold increase in coverage to 200ha from April to December in 1986. A 90 percent reduction in C. prolifera coverage occurred in the fall of 1988 immediately following a "25 year" rainfall event which lowered salinities to 2ppt in some parts of Hillsborough Bay. C. prolifera transect M-3 , located on the northern fringe of the southeastern Interbay Peninsula coverage (Figure 3), was reduced to trace amounts (Figure 18) following the rain event.

The transect study site M-2 near Ballast Point (Figure 3), which had reached nearly 75 percent cover by the summer of 1988, also suffered marked coverage reductions after the "25 year" rainfall event (Figure 19).

C. prolifera was discovered adjacent to the ship channel along the subtidal flats of Davis Island in October 1986. Results from the transect study site Y-1 has shown low percent coverage through Survey 5, and trace amounts since Survey 6 (Figure 20). The initial decline to trace amounts occurred prior to the "25 year" rainfall event, and consequently, was presumably not a result of reduced salinities.

In the northeastern region of Hillsborough Bay, between Pendola Point and Archie Creek, C. prolifera has undergone rapid expansion since first discovered in October 1987. In this area, C. prolifera did not experience a large scale die-off following the "25 year" rainfall event. Salinity reductions near Pendola Point after the rainfall event may not have been as drastic compared to salinity reductions observed along the western side of Hillsborough Bay. The Pendola Point transect study site P-1 (Figure 21), reflects the continued persistence of C. prolifera in this region. The percent cover in study site P-1 transect has varied between 50 and 100 percent since Survey 5.

Since 1986, C. prolifera has rapidly colonized large intertidal and subtidal areas of Hillsborough Bay. Furthermore, this alga appears to be particularly sensitive to extreme salinity reductions that last for extended durations. Despite large coverage losses along western Hillsborough Bay in 1988, overall coverage in Hillsborough Bay was estimated at 200ha in the fall of 1989.

CONCLUSION

Recent water quality improvements in Hillsborough Bay have apparently allowed limited recolonization of H. wrightii into intertidal and shallow subtidal areas of Hillsborough Bay. A majority of the H. wrightii renewal has occurred in the Kitchen (Area 1), although many naturally occurring patches of H. wrightii have been located in western and northwestern sections of the bay.

The 1987 H. wrightii transplanting effort appears to be successful. Two years after the 1987 test plantings in Hillsborough Bay, the material collected from the Courtney Campbell Causeway has increased over 2,000 percent in areal coverage. Further, several intertidal areas in Hillsborough Bay, lacking naturally growing H. wrightii in 1987, have been identified as suitable for seagrass growth. As a result of the 1987 test plantings, these areas now have source material available for natural revegetation processes. The lack of expansion of the Kitchen (Area 1) transplants during early 1989 indicate that questions still remain regarding seagrass transplanting efforts.

C. prolifera persist in deeper waters compared to H. wrightii, indicating that the alga may be a pioneer species in areas of reduced light penetration. The large loss of C. prolifera in the fall of 1988 illustrates the tenuous foothold this alga may have when an estuarine environment undergoes extreme and rapid salinity changes.

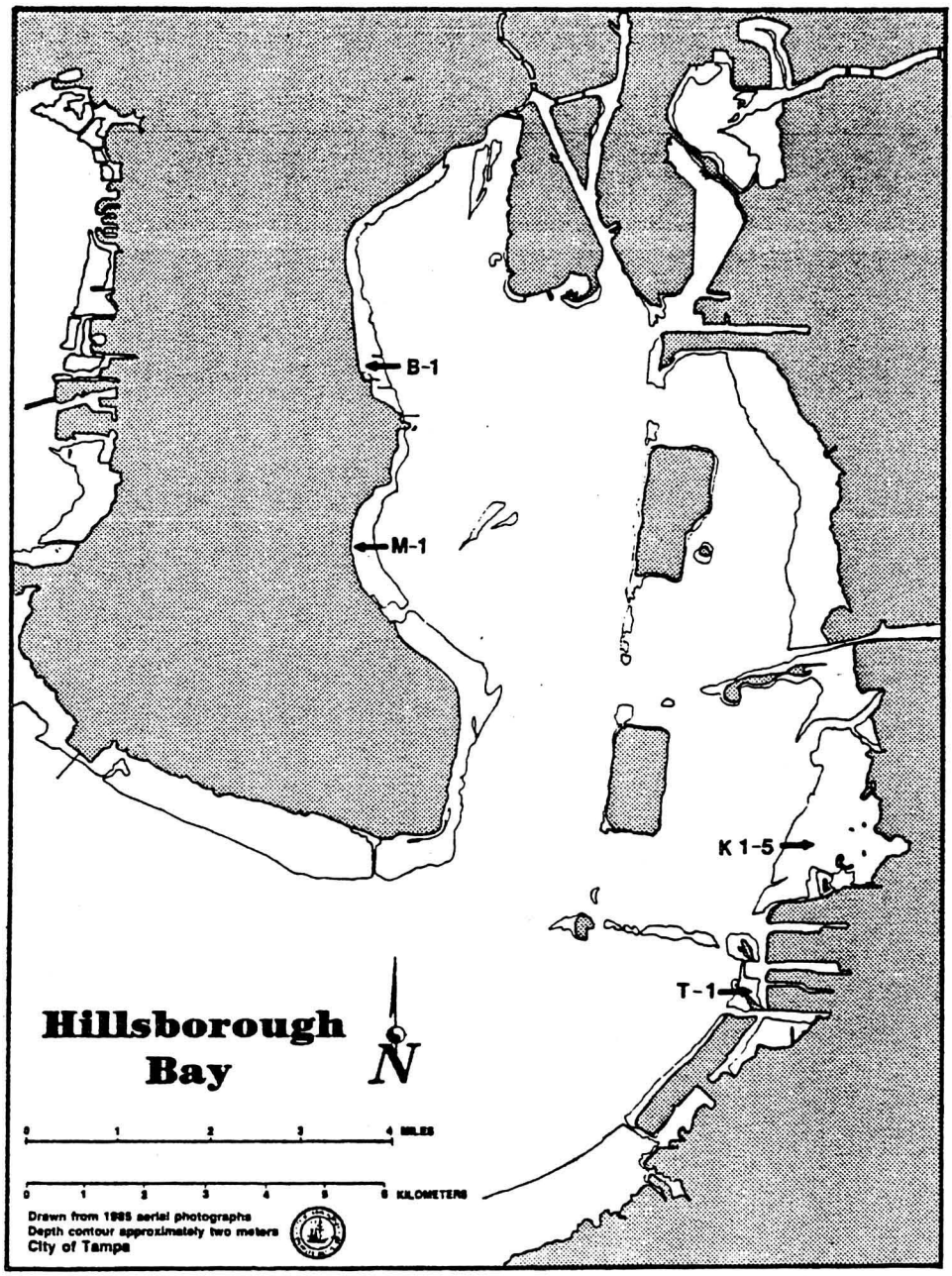

Figure 1. Location of natural Halodule wrightii study sites B-1, M-1, T-1, K-1, K-2, K-3, K-4 and K-5 in Hillsborough Bay.

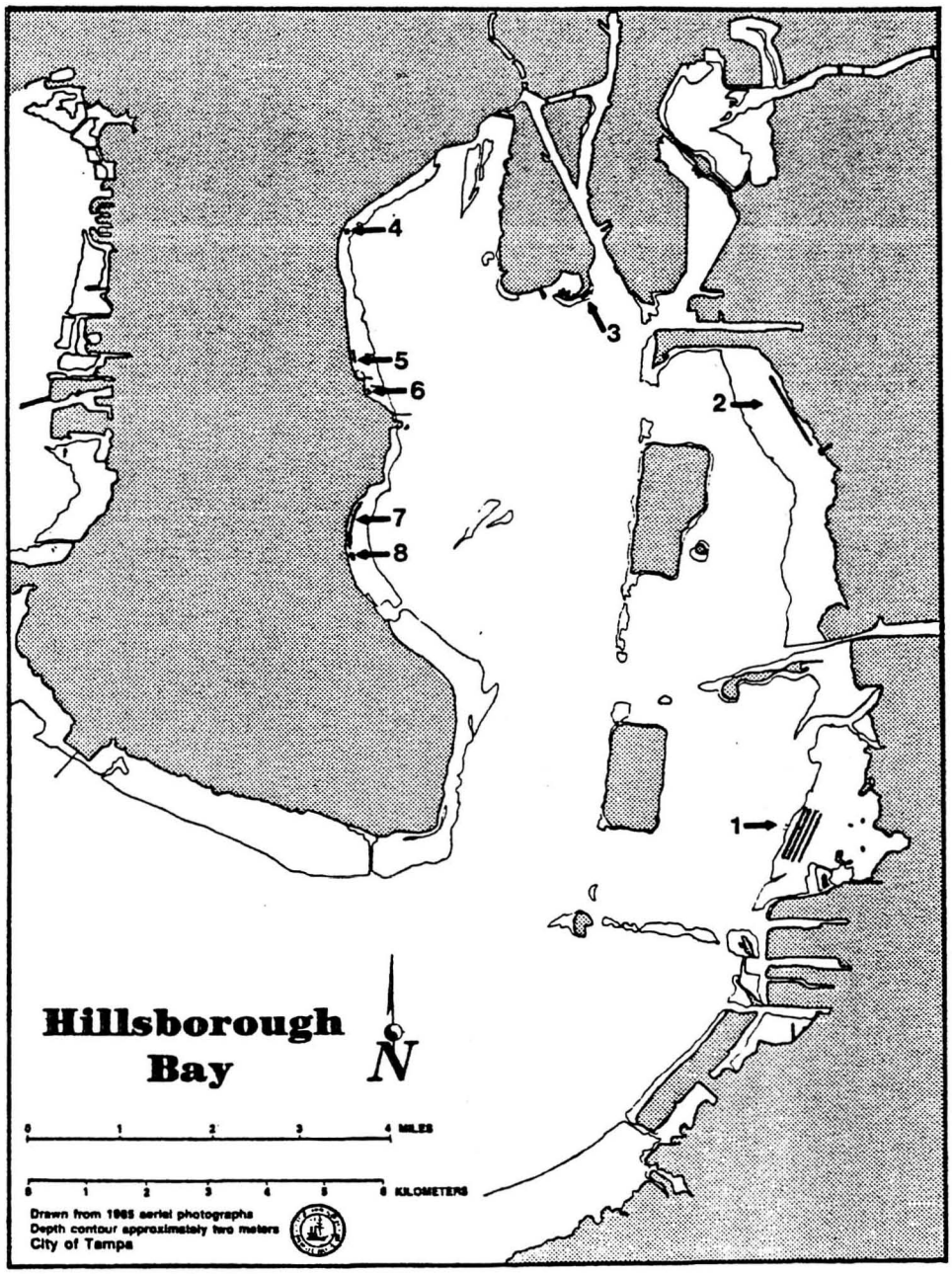

Figure 2. Seagrass testplanting sites in Hillsborough Bay.

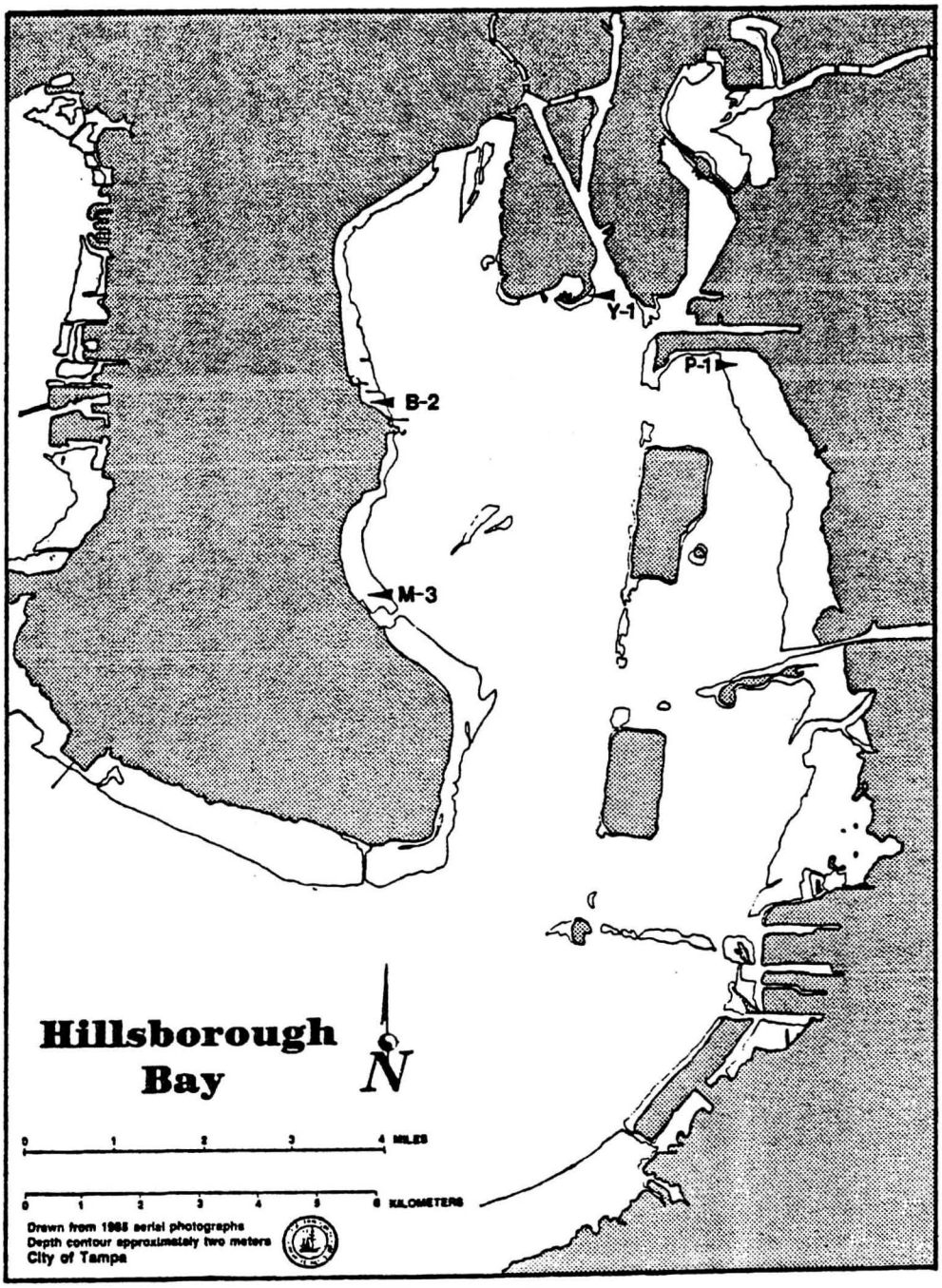

Figure 3. Location of Caulerpa prolifera transects in Hillsborough Bay.

Figure 4. Seagrass testplanting sites in the Kitchen area (Area 1) of Hillsborough Bay. Filled circles show 1987 planting transects and filled rectangles show 1989 planting plots. Locations of natural Halodule wrightii study sites K-1, K-2, K-3, K-4 and K-5 are shown.

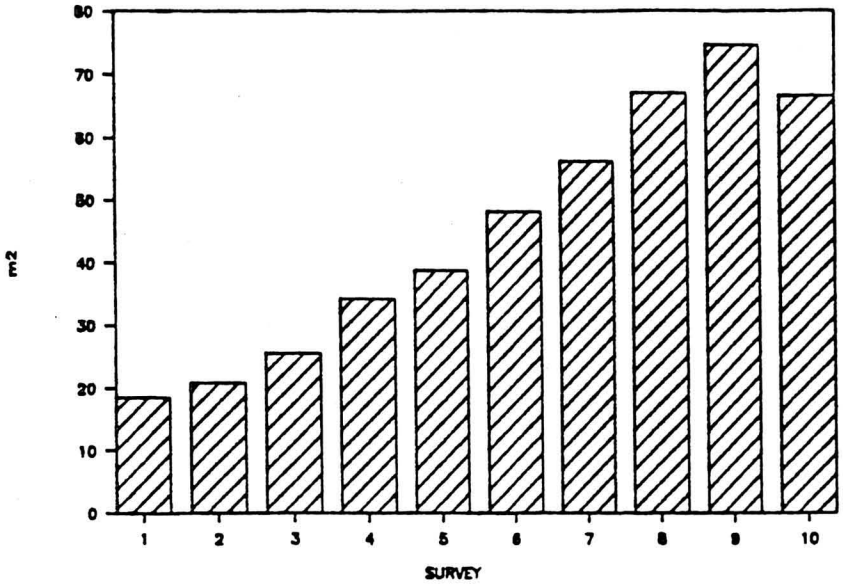

Figure 5. Areal coverage by survey for the natural Halodule wrightii study site K-3.

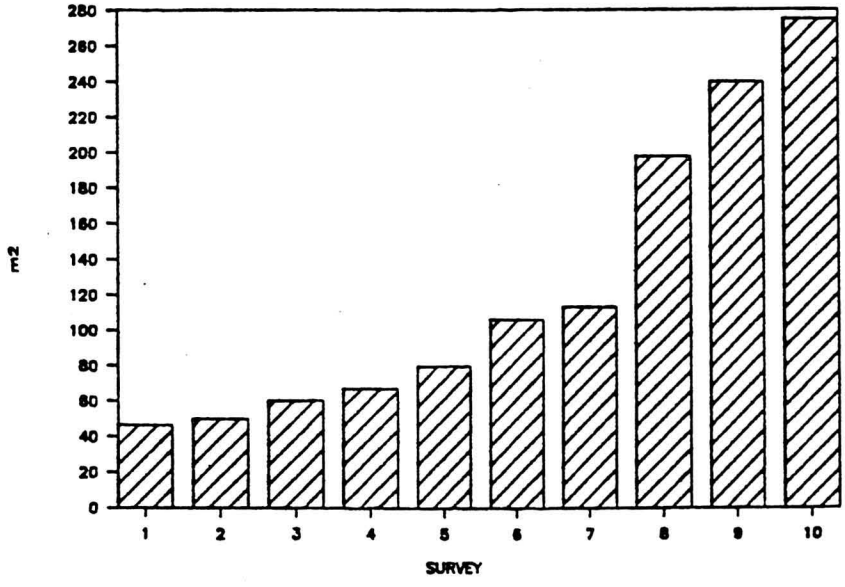

Figure 6. Areal coverage by survey for the natural Halodule wrightii study site K-5.

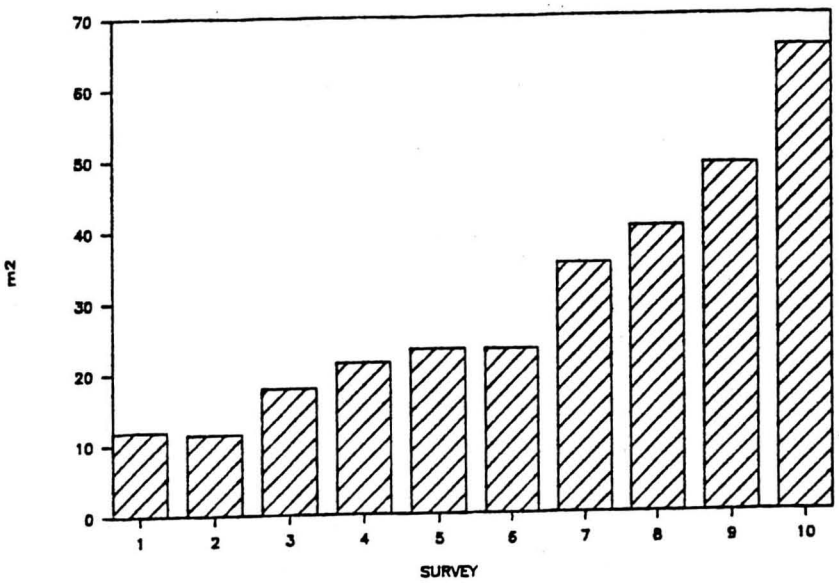

Figure 7. Areal coverage by survey for the natural Halodule wrightii study site B-1.

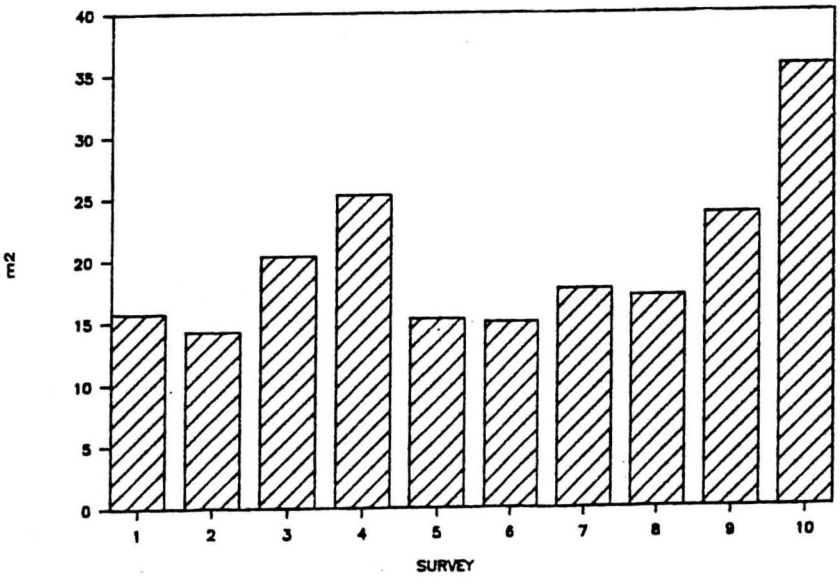

Figure 8. Areal coverage by survey for the natural Halodule wrightii study site M-1.

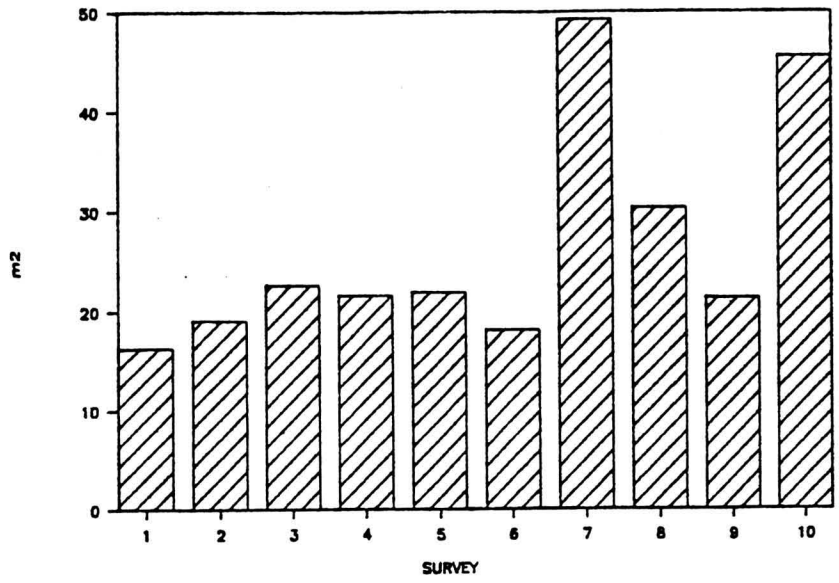

Figure 9. Areal coverage by survey for the natural Halodule wrightii study site T-1.

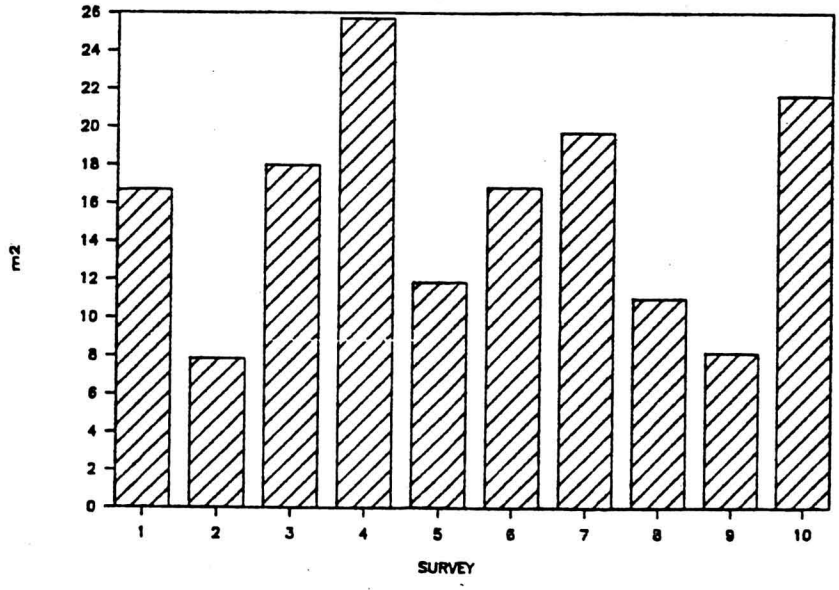

Figure 10. Areal coverage by survey for the natural Halodule wrightii study site K-1.

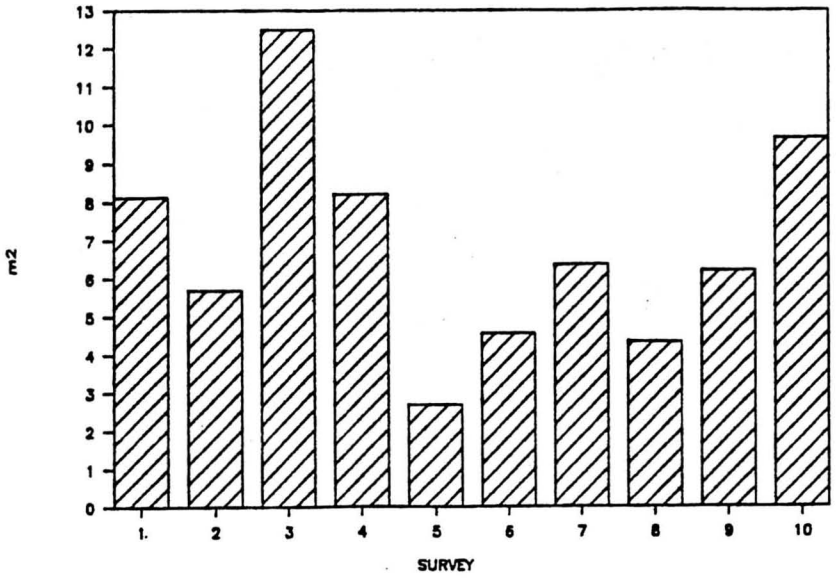

Figure 11. Areal coverage by survey for the natural Halodule wrightii study site K-2.

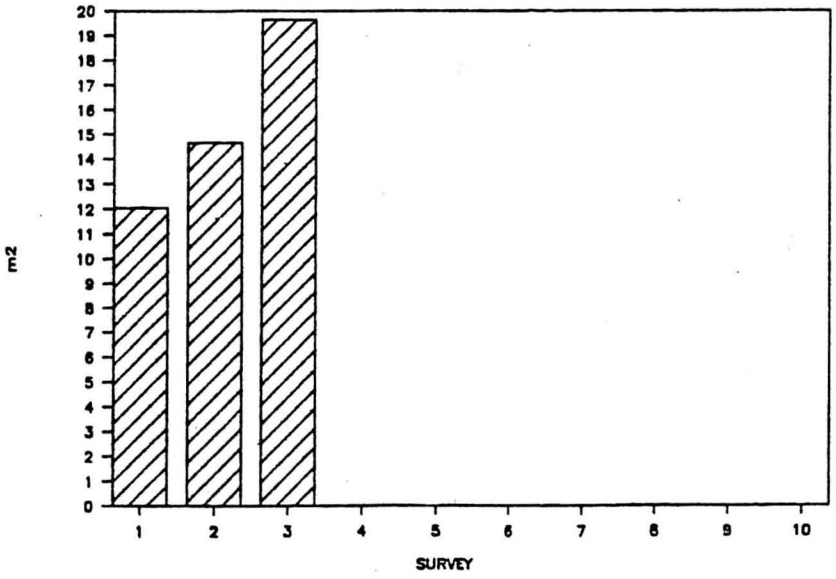

Figure 12. Areal coverage by survey for the natural Halodule wrightii study site K-4.

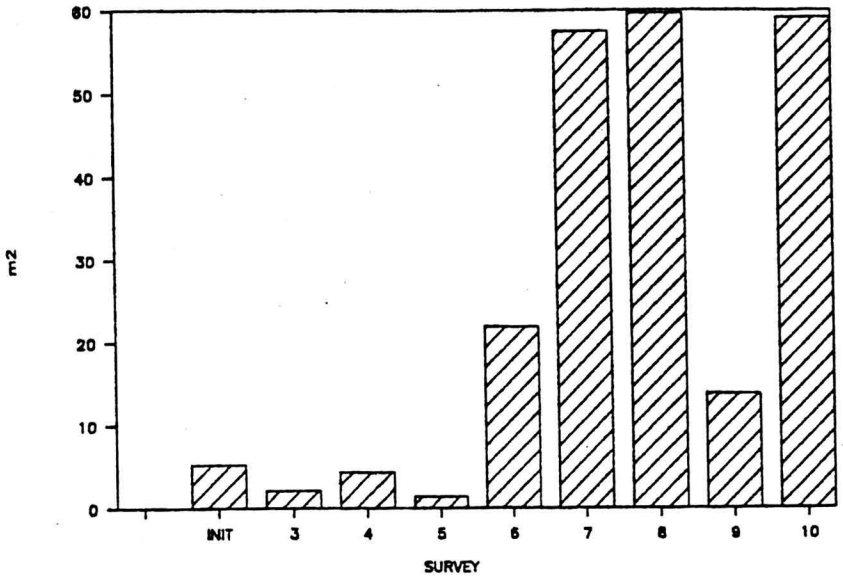

Figure 13. Areal coverage by survey for transplanted Halodule wrightii "sod blocks" in Area 1.

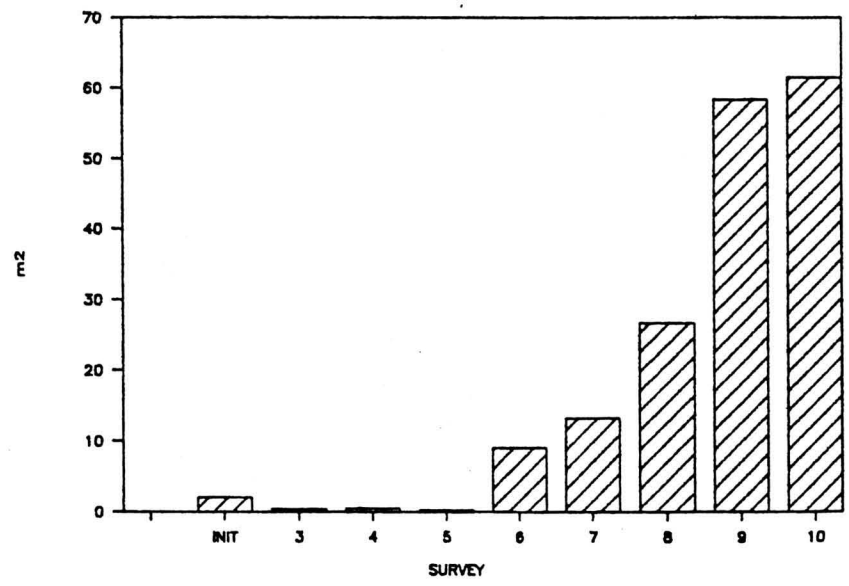

Figure 14. Areal coverage by survey for transplanted Halodule wrightii "sod blocks" in Area 2.

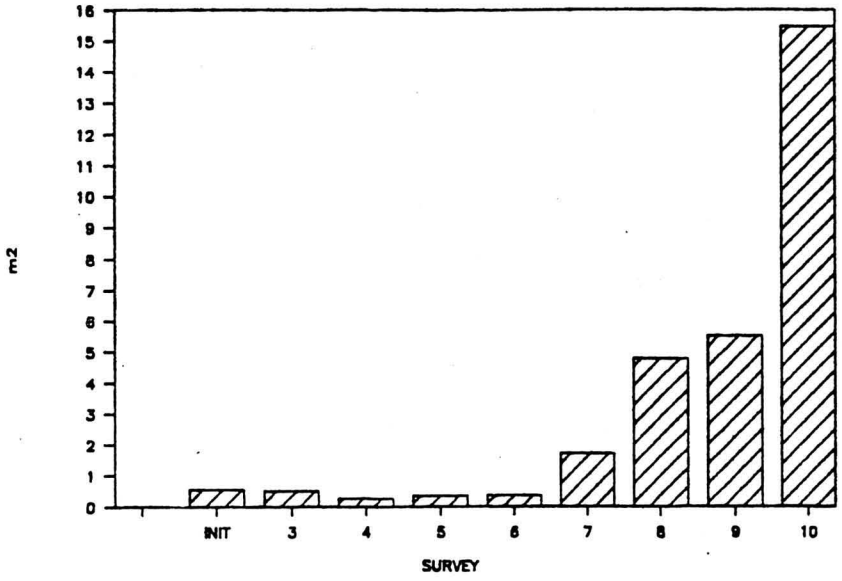

Figure 15. Areal coverage by survey for transplanted Halodule wrightii "sod blocks" in Area 5.

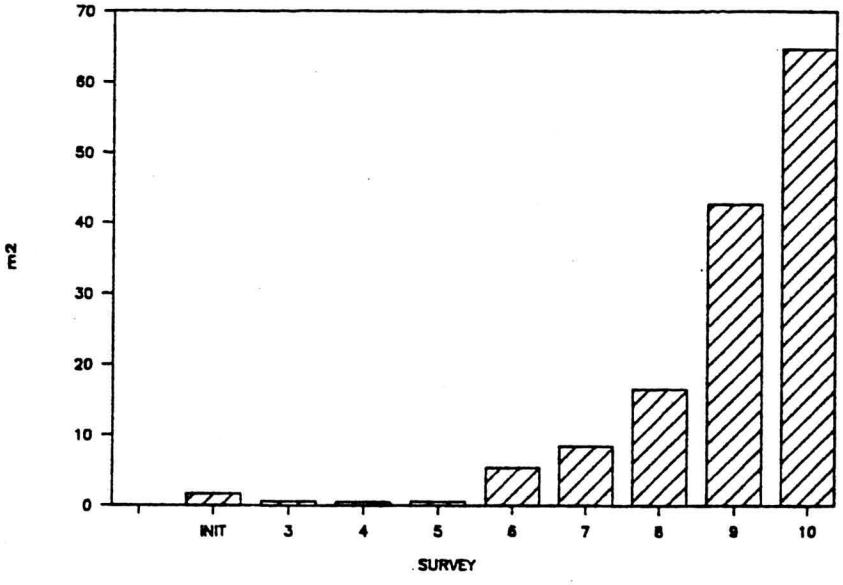

Figure 16. Areal coverage by survey for transplanted Halodule wrightii "sod blocks" in Area 7.

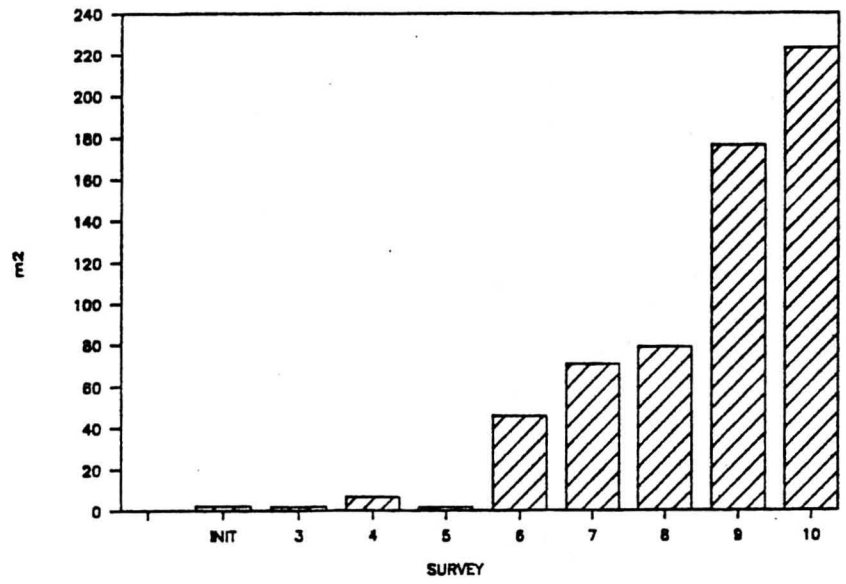

Figure 17. Areal coverage by survey for transplanted Halodule wrightii "bare root" units in Area B.

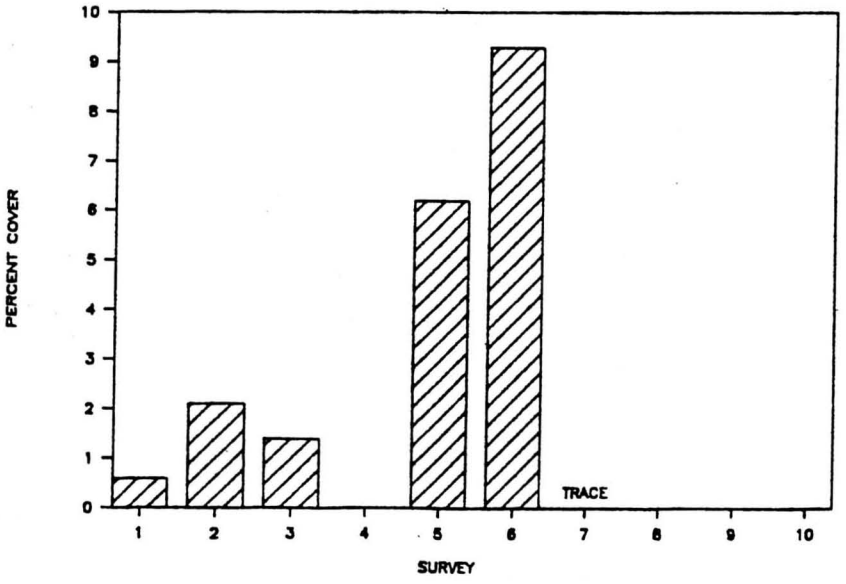

Figure 18. Percent coverage by Caulerpa prolifera at study site M-3.

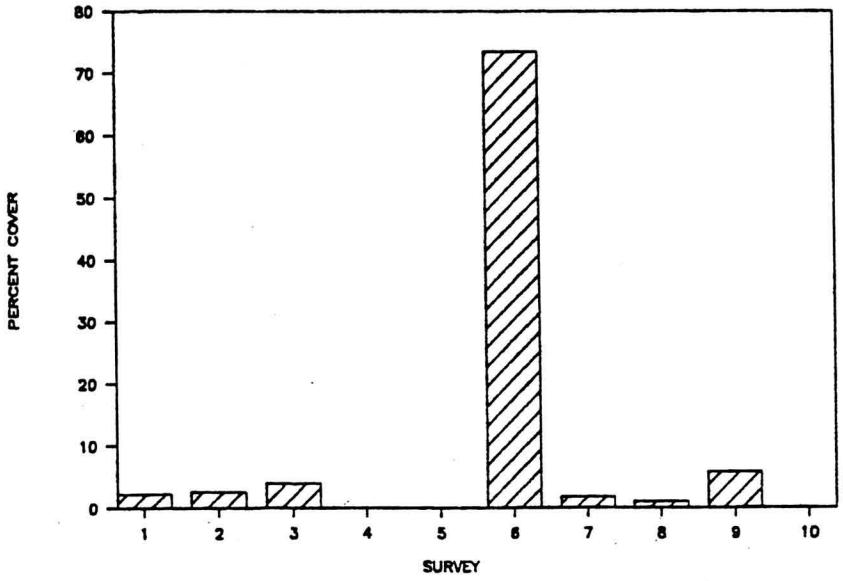

Figure 19. Percent coverage by Caulerpa prolifera at study site B-2.

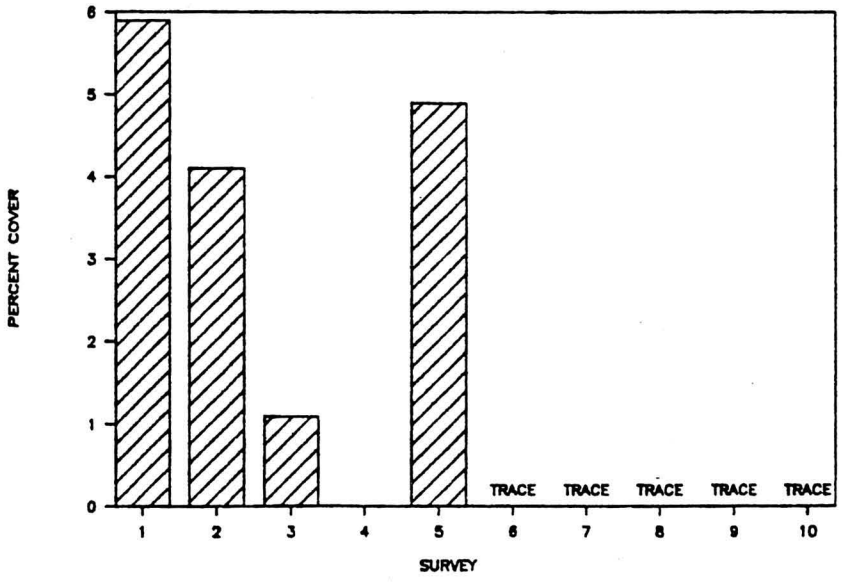

Figure 20. Percent coverage by Caulerpa prolifera at study site Y-1.

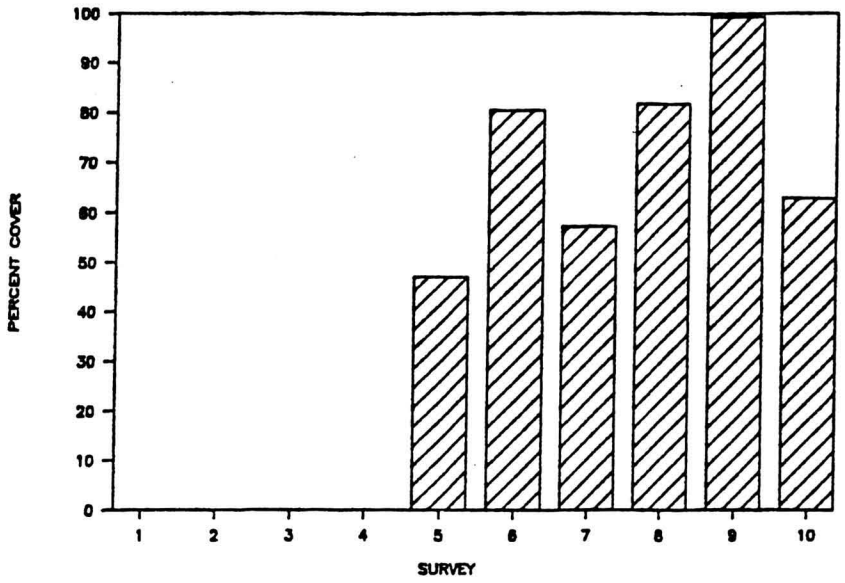

Figure 21. Percent coverage by Caulerpa prolifera at study site P-1.